



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,410	11/12/2003	Eric Wagganer	LAM1P182/P1183	6831
22434	7590	02/04/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP			DANG, PHUC T	
P.O. BOX 70250			ART UNIT	PAPER NUMBER
OAKLAND, CA 94612-0250			2818	

DATE MAILED: 02/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/712,410	Applicant(s) WAGGANER ET AL.	
	Examiner PHUC T DANG	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on election filed January 10, 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 14-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 6-9 and 11-13 is/are rejected.
- 7) ☒ Claim(s) 3-5 and 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>040204</u> . | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 2818

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I (Claims 1-13) filed on January 10, 2005 has been acknowledged.
2. Claim 14 is non-elected claims and still pending in the application.

Oath/Declaration

3. The oath/declaration filed on November 12, 2003 is acceptable.

Information Disclosure Statement

4. The office acknowledges receipt of the following items from the applicant:
Information Disclosure Statement (IDS) filed on April 2, 2004.

Specification

5. The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 2818

6. Claims 1-2, 6-9 and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (U.S. Patent No. 6,380,096) in view of Kim et al. (U.S. Patent No. 6,686,293).

Regarding claims 1-2 and 11, Hung et al. discloses a method for etching to a trench depth in a dielectric layer over a substrate, comprising:

applying an ARC (84, Fig. 5) over the dielectric layer (20, Fig. 5);

forming a photoresist mask (98, Fig. 5) on the ARC, wherein the photoresist mask has a thickness (98, Fig. 5);

etching through the ARC (94, Fig. 5); and

etching a trench (104, Fig. 6) into the dielectric layer (20, Fig. 6).

Hung et al. discloses all the features of the claimed invention as discussed above, but does not disclose the dielectric to photoresist etch selectivity is between 1:1 and 2:1 as cited in claims 1 and 12-13.

Kim et al., however, discloses the dielectric to photoresist etch selectivity is between 1:1 and 2:1 [col. 8, lines 25-43].

It would have been obvious to one having ordinary skilled in the art at the time the invention was made to modify the teaching of Hung et al. to Kim et al. discussed above such that the dielectric to photoresist etch selectivity within the claimed range for a purpose of improving a process etching of a trench in the dielectric layer.

Regarding claims 6-8, Hung et al. discloses during the etching the chamber pressure is maintained between about 60 mTorr and 400 Torr and a high frequency power source provides

Art Unit: 2818

between 500 W and 2000 W and a bias power source provides between 0 W and 1000 W [col. 12, lines 29-35].

Regarding claim 9, Hung et al. discloses the etching the trench comprises providing an etchant gas selected from the group of CF₄, C₂F₆, NF₃ and SF₆ [col. 11, lines 36-43].

Regarding claim 12-13, Hung et al. discloses a method for etching to a trench depth in a dielectric layer over a substrate, comprising:

applying an ARC (84, Fig. 5) over the dielectric layer (20, Fig. 5);

forming a photoresist mask (98, Fig. 5) on the ARC, wherein the photoresist mask has a thickness (98, Fig. 5);

etching through the ARC (94, Fig. 5); and

etching a trench (104, Fig. 6) into the dielectric layer (20, Fig. 6) with a clean etch.

Hung et al. discloses all the features of the claimed invention as discussed above, but does not disclose the range of the thickness of the photoresist mask is between about 2000 Angstroms and 4000 Angstroms as cited in claims 2 and 12 and the dielectric to photoresist etch selectivity is between 1:1 and 2:1 as cited in claims 1 and 12-13.

Hung et al, however, discloses the thickness of the photoresist mask (98, Fig. 5) is 500 nm (Table 4) while the Applicant's thickness is between about 2000 Angstroms and 4000 Angstroms as discussed above. Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to perform the thickness of the photoresist mask within the claimed range, since it is well settled that when the general conditions of a claim are disclosed in

Art Unit: 2818

the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Kim et al., however, discloses the dielectric to photoresist etch selectivity is between 1.5:1 if using Argon and 2:1 to 3:1 if using Carbon monoxide as shown in col. 8, lines 25-43, while the Applicant's the dielectric to photoresist etch selectivity is between 1:1 and 2:1. Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to perform the dielectric to photoresist etch selectivity within the claimed range, since it is well settled that when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Allowable Subject Matter

7. The following is a statement of reason for the indication of allowable subject matter:

Claims 3-5 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

None of the Prior Art made of record discloses a step of forming the photoresist mask of a 193 nm or newer generation photoresist as cited in claim 3 and the photoresist mask is sensitive to aggressive etch chemistries with respect to line edge roughness control as cited in claim 4 and placing the substrate into an etch chamber with an opposing electrode placed opposite the substrate; and heating the opposing electrode so that the opposite electrode reaches a temperature of at least 140°C during the etching the trench into the dielectric layer as cited in claim 5 and the etching gas has less than 5% heavy polymer forming etchant gases as cited in claim 10.

Art Unit: 2818

Conclusion


8. Applicants are advised to cancel the non-elected claims of Group II (claims 14-19) in response to the next Office action if the application is considered to be allowed.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuc T. Dang whose telephone number is (571) 272-1776. The examiner can normally be reached on 8:00 am-5:00 pm.

10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David C. Nelms can be reached on (571) 272-1787. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and After Final communications.

11. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Phuc T. Dang

PP 

Primary Examiner

Art Unit 2818